THE ILLUMINATING ENGINEER

# THE JOURNAL OF GOOD LIGHTING

LIGHT
LAMPS
FITTINGS
AND
ILLUMINATION

OIL
GAS
ELECTRICITY
ACETYLENE
PETROL-AIR
GAS
ETC.

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
J. STEWART DOW

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## Special Features:

Progress in Industrial Lighting—Architectural Courses for Illuminating Engineers—Lighting for Special Trades—The Lighting of Atlantic City Convention Hall—The Protection of Electrical Lampholders—News from Abroad, etc.

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# Progress in Industrial Lighting

THE annual report of the Chief Inspector of Factories and Workshops invariably contains some points of interest, and the report for the year 1929, now available, is no exception. It is satisfactory to note that industrial lighting continues to excite more attention year by year, and that a higher standard of both natural and artificial lighting is now a general rule in all new factories. In old factories, however, unsatisfactory conditions are still encountered, and amongst these special importance is attached to the prevalence of glare. A typical instance is mentioned in the report by Miss Keely. A workroom was adequately provided with powerful lamps, but these were covered with only small reflectors, which left most of the incandescent filament exposed at about eye level. She says " the occupier, who was persuaded to provide much deeper reflectors, was very pleased with the results; the workers were happier and ceased to suffer from headaches and 'bad temper,' and the output during the winter was reported to have increased by 15 to 20 per cent."

This case strikes us as particularly interesting in showing that avoidance of glare may, in itself, lead to improved output. The value of higher illuminations in improving efficiency is often emphasized; but it is perhaps not sufficiently appreciated that a material improvement may often be secured merely by eliminating *the misuse of light*, as exemplified by the presence of troublesome shadows and glare. Another instance mentioned was a factory devoted to the manufacture of lace and hosiery from artificial silk. Complaints of eyestrain were received. An investigation by Mr. Murray led to the conclusion that in this case also the trouble was due to glare from unshaded lamps, and suitably designed reflectors were substituted with satisfactory results.

Several causes of accidents directly attributed to bad lighting are reported. In one case an accident at the lathe was due to the workman being dazzled by glare from an unshaded electric light placed just above his machine. This unfortunate occurrence led to the lighting of this factory being completely remodelled. In the Cardiff district the case of a man falling down an open hatch on the badly lighted deck of a ship was reported. Two other cases also occurred in the Western Division. In one a serious accident happened at a badly lighted machine when the operator was taking a handful of material to test the grade. He could not see the nip of the grinding rolls into which his fingers slipped. The other occurred through an unshaded light glaring in the operator's eyes, and throwing a deep shadow on the back of a leather-cutting machine, thus preventing a worker from seeing a passing boy, who put his fingers in the machine.

Such instances of actual accidents due to inadequate lighting conditions are very useful, and we hope that the Home Office Factory Department will persevere in the effort to collect such data. These facts provide useful " ammunition " for those who are pleading the cause of better lighting. They also afford an indication of the most prevalent defects in artificial lighting and how they can be avoided. It is instructive to observe that all the accidents (except that on the deck of the ship at Cardiff) were due to glare rather than inadequate illumination.

Reference is made in the report of the co-operation of other bodies concerned with different aspects of lighting, such as the Illumination Research Committee of the Department of Scientific and Industrial Research, the National Illumination Committee of Great Britain, and the Illuminating Engineering Society. Problems now being studied by the first of these Committees include the conditions in grinding hulls and silversmiths' shops, and the method of securing good illumination for different processes in docks. A method of estimating glare is being devised, and this is to be applied in order to obtain records in existing factories. Mention was also made of the useful investigation by Mr. H. C. Weston and Mr. S. Adams illustrating the great benefit that can often be secured by the use of special spectacles in the case of very fine processes involving close vision.

One other curious and interesting investigation related to a large jam factory where the windows of the storage warehouses had been glazed with yellow glass to prevent discoloration of the jam by the action of daylight through ordinary window glass. The warehouses were connected by corridors glazed with ordinary glass, and it was noticed that whereas there were always plenty of flies in the corridors they never went into the warehouse. The corridors were then glazed with yellow glass, and the flies disappeared from there also. A record of experiments on this point was recently communicated by the makers of the glass to *Nature*. It appears to be definitely established that the house-fly prefers white light to coloured light, and that red and yellow are the best deterrents. As the former absorbs so much light, it would appear that yellow glass is best, though for other reasons such coloured glass cannot be recommended for general use.

# Architectural Courses for Illuminating Engineers

REFERENCE is made elsewhere to an enterprising departure by the Illuminating Engineering Society in the United States, the organization of a course on architectural subjects for illuminating engineers. It has often been urged that illuminating engineering should be allotted more space in the training of the architect in whose hands the lighting of important buildings so largely rests. So far as we can gather, the study of light is woefully neglected in existing courses of instruction given to architectural students. We believe that this is fully recognized by some progressive architects who have acquired this knowledge in practice. But many others go through life without acquiring it and without enthusiasm for the possibilities of artificial lighting, with the result that lighting arrangements are delegated to others, often at a late stage, when a really good design has become almost impossible. There is ample justification, therefore, for urging that some instruction in illuminating engineering should form an integral part of courses of architectural training.

But, if this is true, the converse is equally evident. A properly trained illuminating engineer comes to have a good knowledge of his tools and their possibilities. He knows what appliances exist, how they can best be utilized, and what illumination will result from any given combination. But his training is purely technical. There is lacking the "background," reinforced by travel, which plays such an important part in the training of the architect.

If, therefore, the architect and the lighting expert are to co-operate effectively—and the need for such co-operation in dealing with buildings of architectural distinction is becoming more and more evident—the latter must share in some degree the outlook of the former. It is just as important that the illuminating engineer should have some knowledge of architecture as it is that the architect should have some familiarity with illuminating engineering. The series of lectures now being arranged in the United States, supplemented by visits to buildings of architectural interest, is a step towards a better understanding. The "Open Forum" for the discussion of topics of mutual interest should also be helpful in creating common ground. We should very much like to see a similar effort in this country. If the Illuminating Engineering Society will take the matter up with leading architectural bodies we feel sure that their efforts in this direction would meet with a cordial welcome.

# Calendar Reform

THE reform of the calendar, advocated elsewhere in this number, has been discussed for many years. To us the desirability of such a scheme as that outlined is evident. Possibly progress has been hampered by undue affection by reformers for their own pet devices. The scheme which we have always favoured assumes 12 months, each of 30 days' duration, the remaining five days in the year not being numbered, but distributed conveniently throughout the year and regarded as public holidays. (In a Leap Year there would be six instead of five of these "holiday days.") We would, however, willingly acquiesce in the somewhat different Blochmann scheme, which is stated to have received support from 14 different countries. Perhaps the League of Nations could be induced to include this project in its programme.

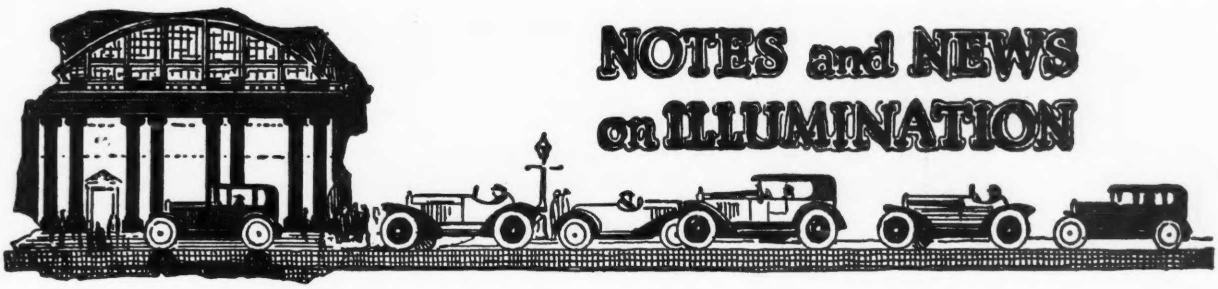
# Natural and Artificial Floodlighting

THE resemblance between the structure of buildings and mountains has often been the subject of comment. It is difficult to escape the impression that the towers and pinnacles characteristic of Gothic cathedrals were suggested by mountain ridges. The buttresses which find a place in such architecture bear a close resemblance to those by which rocky mountains are ascended. There are also not infrequently vertical recesses, which may be likened to the gullies familiar to mountaineers (a good example is afforded by the new Underground building at St. James's Park), and the small ledges which run horizontally along the faces of buildings are reminiscent of the traverses on the faces of mountains. Even the latest forms of modern buildings, in particular the skyscrapers of New York, have a certain resemblance to mountains, though some of these approach nearer to the Dolomitic hills than the Aiguilles in the Alps. The long vertical gullies are here well marked; the setting back of the building in terraces is a familiar effect to those accustomed to mountain scenery. Whereas the pinnacles characteristic of some rocky ridges are found in the design of cathedrals, the skyline of some modern buildings (for instance Grosvenor House, facing Hyde Park) is by no means unlike the ridges of Skye, with vertical "cut-offs" at intervals.

These preliminary remarks lead one to make yet another comparison. It is a familiar fact that the features of a rocky face, seen from a distance in full daylight, are difficult to identify, whereas in a mist many unsuspected features are revealed. The face no longer appears continuous. Successive buttresses appear behind each other. Ledges and recesses in the rock are revealed. These changes are essentially a matter of contrast. In the case of a building, floodlighting, skilfully applied, may serve a similar purpose. Diffused daylight, if not shadowless, does at least give a flat and uninteresting effect. Artificial light, however, is under control, so that a building may be made to look more interesting by night than by day. In the case of buildings whose frontages rise in terraces, each set back from the one below, the illumination can be graded, gradually increasing as the summit of the building is attained, so that each section is marked out from an adjacent one. Such features as colonnades and balconies may often be rendered more evident by artificial light. Concealed lights furnishing a bright background to pillars render them much more striking objects than by day, and if the contrast between pillar and background is thereby reversed this need not necessarily be considered "unnatural."

Finally, there are great possibilities in delicate variation in the colour of light, not only in producing pleasing contrasts but also in causing certain sections to "stand out."

Surfaces which receive illumination in Nature differ widely. Some dark rocks appear sombre even in bright sunlight, whereas light-coloured Dolomitic mountains or snow-covered summit peaks in the Alps furnish excellent subjects for "floodlighting" by the evening sun. The illuminating engineer is similarly handicapped or favoured by the nature of the surfaces of buildings which he tries to illuminate. The light surfaces of most modern buildings are particularly suitable for floodlighting, but the adoption of polished tiles, and especially the more recent idea of covering parts of the exteriors of buildings with polished stainless steel, may render somewhat special treatment necessary.




## Street Lighting in Liverpool

The report of the City Lighting Engineer for Liverpool (Mr. P. J. Robinson) contains evidence of steady progress. The total length of roads lighted has increased slightly (from $622\frac{1}{2}$ to 631 miles), but the existing lighting, both gas and electric, has been improved. At the date of this report $443\frac{1}{8}$ miles were lighted by gas, $186\frac{1}{2}$ by electricity, and 2 still by oil. The number of public lamps has increased from 27,388 to 28,010. In electrically lighted streets the number of 100-watt (in place of 60-watt) lamps has largely increased, and the lighting of various arterial roads has been extended. One interesting point is that two footpaths, hitherto unlighted, have now been illuminated; this is a matter which might well be considered in other cities where paths used considerably by pedestrians exist. Special interest attaches to experiments in the direction of improved lighting in various thoroughfares where glare was formerly in evidence. Enamelled-metal "eye-screens" attached to existing lanterns have proved useful, both in diminishing glare and improving visibility. Another enterprising step is the experimental use in one area of automatic control of public lamps by means of selenium cells. The experiment, which has now been continued for six months, appears to have proved quite successful. As regards gas lighting, whilst the number of lamps in use has been diminished, the lighting has been materially improved, a feature being the substitution of four-light lamps for two-light units. The City Lighting Engineer is also to be congratulated on securing a 20 per cent. discount on the price of gas for public lighting, which has resulted in an annual saving of £2,100.

## The "Grumble Point" in Natural Lighting

This term has been coined to indicate the exact point at which natural illumination becomes inadequate and artificial light becomes necessary. It is somewhat difficult to define this point, even in offices and factories, as much depends upon conditions of contrast, the extent of sky visible, the rate at which daylight is diminishing, and other factors, all of which influence in some degree the judgment of the observer. It is, however, by no means visionary to suggest that in the future the minimum daylight value in such interiors might be fixed, and the automatic switching-on of artificial light when this point is reached provided for by the aid of photo-electric cells. A striking instance of difficulty in defining the grumble point was afforded by the incident at the recent test match at Leeds, when batsmen on the English side successfully protested against the poor light. Such appeals in cricket are always liable to arouse controversy, especially when they are made at somewhat critical stages of the game. It is, perhaps, not unnatural that spectators should sometimes fail to realize the difficulties of the batsmen, and should be inclined to criticize the judgment of the umpire, though both, of course, are in an incomparably better position to determine whether the light is adequate or not, moreover, amongst non-technical people there is apt to be some mental confusion in regard to the conditions that really impair visibility. One cannot help feeling that a conference between leading cricketers and illuminating engineers might be helpful in suggesting remedies! It was, we believe, stated that some form of photometric or light-registering device has actually been used in America, and it was suggested that this might be used in cases of dispute on our cricket grounds. There would doubtless be no difficulty in determining when daylight illumination on the cricket pitch had fallen to a prescribed value. But is this all that is needed? In the accounts of the test match referred to it was stated that the visibility was poor only at one end—apparently the end at which the batsmen had to view the view without any white screen as a background. It is conceivable that one section of the sky might be darker than another, and this might, to some extent, impair visibility. But it would seem that the dominant consideration is the brightness of the background against which the bowler's arm and the flight of the ball are observed. So important does this consideration appear that one wonders why white screens behind the bowler are ever dispensed with. It would surely be better to have an adequate screen at both ends, even if the small section of the seating area in the pavilion was thus obstructed and had to be vacated by spectators. If this were done we should probably hear much fewer complaints of poor light, and there would be no difficulty in providing adequate artificial illumination of the screen during periods of poor daylight illumination.

## Lighting and the Architect

A recent "Architect's Supplement," issued by Electrical Industries, contains a useful article entitled "Electricity in the Modern Home," by Mr. V. W. Dale. A feature is the inclusion of a series of six-line illustrations showing the desirable points in order to obtain comfort in various types of rooms. This is surely one practical need which architects could do a great deal to satisfy. It is singular that when rooms are wired in connection with housing schemes and estates the possibilities of electric lighting are so often limited by parsimony in providing outlets and switches. Proper provisions do not involve very much additional expense if they are made initially when the plans are prepared, but subsequent additions are invariably troublesome and costly. Other articles cover various fields of lighting. Mr. R. S. Mahoney deals with large interiors, Mr. R. Davies with church lighting, and Mr. R. Waldo Maitland with floodlighting. We also notice an effective illustration showing the lighting of the new Royal Horticultural Hall, which has some original and distinctive features.

## An Electrical Summer School

An enterprising departure originated last month was the course on domestic uses of electricity at the Hampstead Training College. This course, the first of its kind, was arranged by the Board of Education for teachers of domestic science. The organization was very fittingly placed in the hands of Miss C. Haslett, director of the E.A.W., and it is hoped that it will become a regular annual event. The B.E.A.M.A. and the E.D.A. are assisting in furnishing equipment. The course naturally deals with the applications of electricity in the home for heating, cooking, etc., but we are sure that Miss Haslett will see that the primary application —for lighting—is not overlooked.


## Venice—An Ideal Opportunity for Floodlighting

Floodlighting of public buildings is becoming quite a usual feature in Continental cities. In the course of a recent visit to Venice, it struck the writer that the possibilities of this method of lighting have been strangely overlooked. There is no need to dwell on the great natural beauties of this city, and the wonderful light effects that take place on a fine evening when the richly coloured buildings lining the Grand Canal are illuminated by the setting sun and the sky and water together assume an intense blue as daylight fades. As yet, however, practically nothing has been done to enhance the beauties of the city by means of artificial light, which is surprising when one considers that during the season the city is thronged by visitors from all over the world, for whom a trip by gondola in the darkness is a standard treat. There is something very appealing in such a journey as the gondola threads its way through the mysterious shades of the canals, passing other craft each carrying its light. (The gondoliers, however, no longer wear quite the same picturesque costume as in the past; a white jacket is universal, and is certainly a practical expedient to enable oncoming craft to be distinguished.) But at night the impression is somewhat sombre. Little can be seen of the wonderful range of buildings lining the canals. Yet these could be revealed to perfection by floodlighting. The conditions in Venice are unique, for the buildings would be visible from afar across the water and there are good facilities for concealing projectors. It may be argued by some that the introduction of such lighting has an unduly "artificial" effect. Yet artificial light is already in use. Public lamps line the streets and quays and in general they have no marked ornamental features, being in fact somewhat glaring and thus interfering with the view of surroundings. The Campanile and the fine San Marco Square, lined by busy cafés in the evening, also suggest themselves as good subjects for floodlighting. In other cities objection is now taken to the floodlighting of buildings of architectural distinction. As an instance we may mention the illumination of the cathedral of Notre Dame in Paris, on the occasion of the recent celebration of the work of Dumas, Victor Hugo and other great French writers of the romantic period.

## Special Lighting Loads

Artificial lighting in connection with evening games and sport seems likely to afford a useful increase in load for supply undertakings. Two somewhat unusual cases have come before our notice. In the *Electrical World*, Mr. D. W. Koppes discusses the lighting of miniature golf courses. Some cities in America have as many as twenty or thirty of them, and, in general, courses are crowded to full capacity. On night-lighted courses an average illumination of at least 6 foot-candles is aimed at, and for the average-sized course about 15,000 watts per hour per course is required. Most illuminated courses do a steady "full house" business from 7 to 11 o'clock. Four hours' illumination for seven days a week means 420 kw.-hours per week. Four months is certainly a minimum estimate of the period during which the lighting is needed. The average course will consume about 6,500 kw.-hours per year—a very useful load when the aggregate effect of a number of courses in the same city is considered. Another special load, mentioned in B.J.P., is the lighing of skating rinks. This, of course, is a less usual proposition. There are a number of conditions necessary to render an artificial skating rink practicable. It should be in the open air (both from motives of economy and because under this condition the pastime is more agreeable), and it should be situated in a country where the temperature never rises more than a few degrees above freezing point from October to March. These conditions are fulfilled in Vienna, where there exists the largest open-air rink in Europe, on which hundreds of people can skate simultaneously. This space is lighted by lighting units mounted 6 metres above the ice and affording an illumination of about 40 lux (approximately 4 foot-candles). A space is reserved for ice hockey, and here a higher illumination of the order of 80-100 lux is provided. The installation has a total load of 52.5 kw. On several occasions during the year fêtes and fancy dress balls are arranged, supplementary coloured lighting being then provided.

## Photo-Electric Cells in Chemistry

In the *Transactions* of the American Illuminating Engineering Society we notice that mention is made of a new application of photo-electric cells. Many chemical analyses depend on the identification of a colour-change or the commencement of precipitation rendering a solution milky. Such changes are gradual and the determination, by visual inspection, of the exact point at which the change begins demands considerable practice. By using a photo-electric cell, illuminated by a beam of light passing through the solution, the commencement of the reaction may be noted with greater precision. It may even be arranged for the process to be automatic, the diminution in light causing the ringing of a bell, or even a record by an electric pen on a sheet of paper. Evidently this method would answer for a solution which becomes milky or more opaque, and by an arrangement of filters a colour change could be made equally recognizable. The idea is closely analogous to the replacement of a visual photometric test by a photo-electric method.

## Illuminating Engineering in South Africa

We recently referred to the promising start made by the S.A.E.L.A. Lighting Service Bureau in Johannesburg, which is under the direction of Mr. E. S. Evans. We have now before us the first of the "Electric Illumination Handbooks," issued by that organization which is entitled "Illumination Design Data." It resembles in scope the similar bulletins issued by the E.L.M.A. Lighting Service Bureau in this country, and we have already received indications that it is becoming familiar. Mr. Evans has recently been undertaking a tour in South Africa, where an excellent field for propaganda in favour of better lighting exists. The chief cities of South Africa already possess many excellent lighting installations, but there are many engineers in remote districts who have to handle lighting problems and who would appreciate help.

# TECHNICAL SECTION

COMPRISING

**Transactions of The Illuminating Engineering Society and Special Articles**

*The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.*

# New German Recommendations for Artificial Lighting Installations

REALIZING that there was scope for improvement and modernization in the existing recommendations, the German Illuminating Engineering Society appointed a committee to deal with "Practical Illumination." The Committee has recently submitted a draft of suggested recommendations, drawn up in co-operation with the German Ministries of Labour and of Trade and Commerce, the Berlin Commissioners of Police, the Electrical Contractors' Association, and others, which are now open for consideration by the members of the Society.*

The recommendations are incorporated in two main sections, one of which deals with principles and data whilst the other furnishes the necessary explanations. Commencing with the axiom that artificial illumination must embody appropriateness and economy together, due consideration being paid to hygienic and æsthetic considerations, fundamental principles are outlined. The report emphasizes the importance of (1) adequate volume of light, (2) correct control of shadows, (3) uniformity of illumination both as regards time and distribution, (4) suitability of the diffusing and directing media, (5) correctness of colour; all these factors should be properly related to the requirements of the work, the nature of the premises and other local considerations.

## Recommendations

A. QUALITY OF THE ILLUMINATION.

I. *Intensity.*—Two varieties of illumination are deemed representative: (*a*) general illumination or (*b*) general illumination supplemented by local lighting. The recommendations for intensity are under three headings:—

(1) *Working Places, including Schools.*†

| Class of work | Only General Illumination: Average Lowest | Average Recommended | Minimum in worst spot | General Illumination and Local: General Average | General Minimum in worst spot | Local at working place |
|---|---|---|---|---|---|---|
| Coarse | 20 | 40 | 10 | 20 | 10 | 50-100 |
| Medium | 40 | 80 | 20 | 30 | 15 | 100-300 |
| Fine | 75 | 150 | 50 | 40 | 20 | 300-1000 |
| Very fine | 150 | 300 | 100 | 50 | 30 | 1000-5000 |

The values given are in lux (1 lux = approximately $\frac{1}{10}$ foot-candle). The values assume a reflection of from 40-60 per cent. from the work or the working place. The relative importance of local and general illumination is discussed in the explanatory matter.

(2) *Residential and Other Rooms.*

| Requirements | General Illumination: Average Lowest | Average Recommended | Minimum in worst spot |
|---|---|---|---|
| Moderate | 20 | 40 | 10 |
| Superior | 40 | 80 | 20 |
| Highest | 75 | 150 | 50 |

The values are again given in lux in this and subsequent tables, and the reflection from the surroundings in the room is again assumed to be from 40-60 per cent.

(*b*) Local lighting values as under (1 *b*) above.

(3) *Traffic Ways.*

| Type of Installation | Average Illumination Lowest | Average Illumination Recommended | Minimum in worst spot Lowest | Minimum in worst spot Recommended |
|---|---|---|---|---|
| A. *Streets & Open Places* | | | | |
| With sparse traffic | 1 | 3 | 0.2 | 0.5 |
| With medium traffic | 3 | 8 | 0.5 | 2 |
| With heavy traffic | 8 | 15 | 2 | 4 |
| With very heavy traffic ... ... ... | 15 | 30 | 4 | 8 |
| B. *Passages & Stairs* | | | | |
| With sparse traffic | 5 | 15 | 2 | 5 |
| With heavy traffic | 10 | 30 | 5 | 10 |
| C. *Railway Premises Shunting Yards* | | | | |
| With sparse traffic | 0.5 | 1.5 | 0.2 | 0.5 |
| With heavy traffic | 2 | 5 | 0.5 | 2 |
| *Platforms, Loading Bays, Corridors & Stairways* | | | | |
| With sparse traffic | 5 | 15 | 2 | 5 |
| With heavy traffic | 10 | 30 | 5 | 10 |
| D. *Waterways, Quays, Piers, Locks* | | | | |
| With sparse traffic | 1 | 3 | 0.3 | 1 |
| With heavy traffic | 5 | 15 | 2 | 5 |
| E. *Factory Yards* | | | | |
| With sparse traffic | 1 | 3 | 0.3 | 1 |
| With heavy traffic | 5 | 15 | 2 | 5 |

The recommended values should be adopted except in such instances where the nature of the place, the kind of work done and the size and class of material handled can justify a lower value. In some places the illumination may be reduced, when traffic is diminished, to one-third of the recommended value.

II. *Shadows.*—At all working points at least 20 per cent. of the light is to be directive (shadow coefficient 0.2), but care is to be taken that there are no intense shadows; the illumination in the shadow is not to be less than 20 per cent. of that which would be present if no

* *Licht und Lampe,* May 15th and 29th, 1930.

† A schedule will be issued later co-relating these classes with various industries.

shadow was thrown (i.e., maximum shadow coefficient 0.8). There must be no sudden contrast in the illumination. The direction of rays from non-diffuse sources must be such as to produce no disturbing shadows due to either fixed or moving objects.

III. *Uniformity of Illumination.*—The diversity factor must be such that the difference in illumination between adjoining rooms is not noticeable in buildings nor in adjacent areas between neighbouring streets.

IV. *Periodic Variations*, if any, should take place either so slowly or so quickly as to be unobservable.

V. *Glare*, whether due to the light source or the fitting, or to reflection, must not be present. Glare is recognized to be caused mainly by *contrasts in intensity;* as yet, however, it is not feasible to specify coefficients to define this contrast. However, as the intrinsic brilliancy of most light sources furnishing the before-mentioned illumination intensities is liable to cause glare, the following brilliancies should not be exceeded:—

(*a*) In fittings for local (working place) illumination the rays between 75° and 180° from the vertical should not exceed 0.2 *stilb.**

(*b*) In fittings for general illumination the rays between 30° and 90° from the vertical should not exceed 0.3 *stilb.*

(*c*) In fittings for outdoor illumination the rays emitted between 60° and 90° from the vertical should not exceed 2 *stilb.* Although there may be difficulty in achieving these results they should be achieved so far as possible, seeing that in many installations glare is the chief defect, although often unrecognized.

VI. *Colour of the Light.* This should not differ greatly from natural light. The extent to which artificial daylight or "semi-daylight" is used must depend on the class of work done and the need for correct estimation of colours.

VII. *Blending of Different Classes of Illumination.* Care must be taken that shop-window and advertisement lighting does not interfere with the street lighting, and especially not with luminous traffic or other signal or warning devices.

B. Economy, Installation, Operation and Maintenance.

The seven sections concerning these subjects cover the familiar items, namely: (1) The economy derived both in regard to increased output and diminution in errors and accidents when ample light of correct nature and incidence is available; (2) the importance of good workmanship and material in the permanent parts of the installation; (3) the desirability of periodic inspection and, in certain instances, of an emergency supply; (4) the advisability of replacing lamps or mantles when they have aged; (5) the necessity of periodical cleaning of the lamps, fittings and reflectors; (6) the removal of accumulations of any products of combustion and unhealthy hot air; (7) the adaptation of the fittings to æsthetic surroundings.

C. Duration of the Illumination.

Artificial illumination should be commenced directly the recommended values cease, inside buildings, to be obtained from daylight and for traffic ways from half an hour after sunset to to half an hour before sunrise in the winter months, the interval being increased to three-quarters of an hour in summertime; but this class of lighting to be always available in foggy or abnormally dark weather.

The second section consists of supplementary explanatory matter. The following sections have been selected as worthy of special attention. The letters and numbers are those differentiating the various parts and their divisions or subdivisions in the first main section.

* The *stilb* is a unit of brightness, and is equivalent to one candle per sq. cm. (approximately six candles per sq. inch).

## Explanatory Matter

A. Quality of the Illumination.

1. *Intensity.*—The rapidity with which the determination of the appearance, contrast or shape of an object is effected depends on the powers of observation of the eye, and is closely related to the illumination of the objects within its field of vision. Visibility involves capacity to differentiate and distinguish shapes, as well as rapidity of observation, and necessitates a definite illumination of the object to be observed. As the illumination is dependent both upon the amount of light falling on the object and on its reflecting or transmitting capacity, surfaces which have poor reflective power require more powerful illumination than if they had greater reflective power.

In order to observe small contrasts a higher degree of illumination is necessary, and the same is the case if the observed dimensions of the object or its details (the size of its image cast on the retina) are small; for the smaller such dimensions the greater is the illumination required. It therefore follows that different classes of work and materials demand diverse degrees of illumination.

The values scheduled in subsections 1, 2 and 3 can only represent average values for the customary class of work in places where a mean reflection of from 40 to 60 per cent. from the material utilized or the working plane is present.

Where reflection is poor and the contrasts are small (i.e., sewing black materials with black thread) or where the walls, ceilings and furnishings have a small reflective power, and where shadow effects are difficult to secure, the degree of illumination suggested must be considerably increased.

It may, however, be generally accepted that the illumination at a working position should be between 50 and 200 lux, as measured on a white surface, the necessary illumination being then achieved by the diffusion resulting from reflection. Obviously, what applies to the illumination of specific working positions applies equally to the illumination of a room in general, as, in any case, the type and the arrangement of the luminous sources, as well as the furnishings, determine the effective illumination.

II. Shadows.

(*a*) *The significance of shadows and their measurements.*

The recognition of plastic form is enhanced by contrast in illumination, which results not solely from different amounts of reflection, but also from direct and secondary shadows; consequently illumination should possess a shadow-producing property.

An opaque body placed between the source and an illuminated surface generates a projected shadow (the core shadow and the semi-shadow). Uneven surfaces on the object produce diffused secondary shadows, because the adjacent small areas receive light falling at different angles and consequently have different degrees of illumination. If one of the light sources of an area is screened, the amount of its direct illumination is deducted (the screened quantity), but a certain degree of illumination remains. The quotient obtained by dividing the screened by the unscreened illumination is called the "shadow value of the illumination." The "shadow value illumination" may be determined by a shadow measurement. The apparatus for this purpose enables both shadow and illumination measurements to be taken independently in rapid succession.

By means of the Ostwald "grey ladder" the shadow values are easily demonstrated and reproduced, as each step on the "grey ladder" has a particular value, indicating the shadow equivalent on a white background.

(*b*) *The effect of the number, kind and arrangement of the light sources on shadows.*

With one point source only a "core" shadow is cast. With more than one such source a like number of shadows will be cast, and in the area where these

shadows overlap the main shadow occurs. If the light source is diffused, a "semi-shadow" is projected beside the core shadow, which, if the source is widely extended, may be entirely eliminated. The width of the semi-shadow zone is independent on the size of the object. It increases with the enlargement of the light source and the distance of the object from the illuminated surface, but decreases with the distance of the object from the source. Large illuminated surfaces, such as ceilings and walls, produce the same effect as extended light sources.

A core shadow surrounded by a semi-shadow with regular or graduated decrement of shadow value is less disturbing than a pure core shadow. The actual diversities of illumination are then less noticeable, as the sensitivity to light variation with gradual decrement is less than with a sudden diminution.

The shadow-generating quality depends on the light sources, their number (subdivision) and arrangement, as well as the light projected from the ceiling and walls. The greater the quantity of illumination which is emitted from large area sources and by reflection from walls and ceilings, the less marked are the shadow effects.

Disturbing shadows may be obviated to a great extent in practice by placing the light sources so that people, moving objects or parts of machines, and the movement parts of the workers rarely throw shadows on the surface or material being used.

The direction of main shadows, that is to say, the direction of the incident light and secondary shadows, should never be permitted to cause unnatural appearances. Therefore the illumination must be arranged so that the light comes mainly from an elevation falling either vertically or at an angle.

### III. Uniformity of Illumination.

The sensitivity of the eye to contrast and shape is increased with the diminution of the diversity of illumination at or near the working position. Consequently, improved general illumination secures increased power of observation. If local illumination is provided, this must be greater than the general illumination, which, however, may also require to be augmented.

The eye accommodates itself to variations in illumination such as occur during the course of a day, but the power of vision is most effective with a medium degree of light. The eye can, however, adapt itself to both light and darkness. An eye adapted to bright illumination is scarcely able to see when in the dark, whilst an eye adapted to darkness finds difficulty in making observations in light. A definite time is required for the adaptation of the eye, being longer for adaptation from light to dark than in the reverse sense. Hence it is advantageous, in the interests of safety, that adjacent rooms, which have to be traversed in sequence, should have but small differences in illumination.

Diversity of illumination may be controlled by the choice of suitable illuminating devices, with proper diffusing capacity, of adequate number, correctly placed as to height and separation, and by the utilization of ceiling, wall and furniture reflection.

### IV. Periodic Variations.

Variations in luminous intensity, apart from very slow and gradual alterations, have the same disadvantage as a high degree of diversity and cause very rapid tiring of the eye, which increases with the amount of variation and the rapidity with which it takes place.

The light obtained from alternating-current circuits, with a frequency of 50 periods per second, appears to be free from flicker, while if the temperature of the light-emitting body remains sufficiently constant, the variations incurred by lower frequencies are not noticeable in incandescent lamps with a stout filament, even when connected to $16\frac{2}{3}$ period circuits.

Very rapid variations of the intensity of illumination, although not visually observable with fixed objects, are rendered so on moving ones by stroboscopic effects. Under certain conditions these have disturbing results, as rotating objects may appear stationary or rotating slowly forward or backwards. This effect is often seen in flywheels driven by synchronous motors, the blades of ventilating fans and similar apparatus when illuminated by lamps connected to an alternating-current circuit of the same frequency as that supplying the motor.

Where stroboscopic effects occur, protective or warning devices should be used.

In gas-lighting installations any variation in intensity resulting from alteration in the gas pressure may be remedied by varying the gas or air admission of the burner.

### V. Glare.

Glare is caused by excessive excitation of the retinal surface and diminishes the sensitivity of the eye. The effects of glare increase with the intensity of the light from the glare-producing source, this increase depending on the ratio of this illumination to that of the rest of the field of vision and to the magnitude of the image of the glare-producing source on the retina. It is greatest when the glare source is in the centre of the field of observation (in-field glare) and diminishes as it approaches the borders of the field (ex-field glare).

Ex-field glare is less if the light source is larger and above the direction of view than if it is to the side or below it. If the illumination of a fixed object is less than that of the surrounding area, or the background, ex-field glare may occur. For instance, this occurs when the objects in a room are observed with a bright window as a background. The presence of glare can be determined in a simple manner by concentrating vision on an object and screening the eye in the direction from which the glare appears to emanate. If the object then appears better defined it is obvious that glare is present.

Glare diminishes the visual capacity of the eye in the same way as bad or insufficient illumination, and therefore hinders all operations dependent upon good vision; inducing uncertainty and discomfort, thus leading to diminution of quality and quantity of production, and increasing the liability to accidents.

The fact that so many different factors influence the degree of glare prevents any limits being stated in general terms. Those mentioned in V. a-c for various degrees of illumination can only be considered as guiding values. The high intrinsic brilliancy of sources at present in use renders it imperative that they should be used with diffusing media.

*Prevention of in-field glare.*—The light sources must be screened by means of opaque reflectors or their brilliancy should be diminished by diffusing material (mottled glass) incapable of direct light transmission (paper or textile shades). Glass, even when etched, is insufficient for preventing glare from incandescent lamp bulbs. In-field glare reflection can be diminished by altering the position of the sources or that of the eye relative to the reflecting surface, so that the directions of reflection and of observation are not identical. In order to observe this condition it is desirable that working places should have adjustable fittings. For work involving writing with lead or copying-ink pencils the utilization of matt paper is recommended. Office appliances with polished metal parts, now commonly used, should be avoided.

*Prevention of ex-field glare.*—Ex-field glare on the edges of the field of vision originated by lighting devices may be eliminated by increasing the illumination both of the working position as well as of the background, and by increasing the angle between the direction of view and that of the projected light.

Ex-field glare in the neighbourhood of the working position caused by widely extended luminous surfaces, such as ceilings and walls, used for totally indirect and semi-indirect illumination, can be overcome by increasing the illumination on the working position (for instance, by local lighting) or by increasing the reflection from the working surface or diminishing reflections in its vicinity.

A. VI.—Colour of the Light.

Where coloured objects are required to appear in their natural true colours as in daytime, luminous sources or fittings emitting as nearly as possible daylight colour should be used. Such illumination, owing to its constancy, is often preferable to natural daylight. In situations where natural light has to be supplemented by artificial light, or when an approximate similarity of the colours to those in diffused daylight is all that is needed, luminous sources or fittings emitting approximately daylight colour may be utilized.

As artificial daylight appears pale, cold and unfriendly if the intensity of illumination is small, it is desirable to furnish, over the working area, an illumination almost equal to that obtainable from ordinary diffused daylight in enclosed premises.

For display purposes with extra brilliant illumination, objects may be advantageously illuminated by coloured lights.

The recognition of fine detail, such as slight fissures in polished surfaces, is facilitated by the use of monochromatic light.

B. I.—Economic Value.

The true value of illumination is not defined solely by the installation and maintenance costs but also by what is achieved in improved production and cleanliness. If the illumination is inferior, owing to its insufficiency or to the presence of glare, longer time is required for production than would be the case if adequate and correct illumination was available. This increased time and labour invariably causes greater expense than the apparent saving attained by failing to utilize either suitable lighting apparatus or sufficient light. Therefore, measured in terms of production, good illumination is always cheaper than bad.

2.—The Design of Lighting Installations.

The carrying-out of illumination installations should always be preceded by the working-out of a systematic lighting scheme, prepared, if possible, at the time the building is planned, but under all circumstances the illumination design should be completed before any wiring is undertaken.

In preparing a scheme the fullest information should be available concerning:—

1. The illuminant; if electricity, the current, voltage (and frequency if alternating); if gas, the pressure and calorific value.
2. The plan and elevation, with details of the stairways and entrances.
3. The finish of the ceilings, whether light or dark, polished or panelled, and the number, arrangement and depth of the panels.
4. The kind of wall surfaces, whether light or dark, with or without frieze, flat or with projections, recesses, glass partitionings, etc.
5. The size and positions of the windows and roof lights.
6. The operations to be carried out and the furnishings; the type, position and size of the working tables, benches and operating machines; particulars of the seating or standing places of all workers; the position and size of cupboards, shelving, etc. The reflective value of the material likely to be used and of the furnishings.
7. Particulars respecting cranes, lifts, shafting, large conduits for heating, ventilation, cooling, etc.
8. Particulars respecting any dangerous parts (such as hatches and cellars).

All these data should be furnished as early as possible, and marked on the plan. It is also desirable to ascertain in the first instance, whether simple universal illumination is required or whether this is to be supplemented or partially replaced by local lighting.

As simple general illumination entails even distribution of ample light on working surfaces or traffic way, either the direct, semi-direct or totally indirect method may be adopted, the lighting fittings being properly spaced and mounted at ample height.

When the installation is undertaken it is well to arrange that the "intensive" projectors of light be kept high up, as in this pattern of fitting the illumination depends only to a limited degree upon the height of suspension, while the diversity is lessened and glare obviated by this arrangement. When adopting indirect or semi-indirect illumination, care must be taken to secure even illumination from the ceiling and wall surfaces.

Where large window surfaces are involved light-coloured blinds should be provided to prevent the loss of luminous rays through the windows, as well as to obtain valuable reflection.

When planning exterior illumination, the following particulars should be given:—

1. The illuminant, with details as mentioned above.
2. Plan of the area and sectional elevation.
3. The shadow-creating objects, such as trees, cranes, columns, poles, etc.
4. The class of work to be undertaken and the nature and density of the traffic.
5. The traffic and other signals.
6. Damper points, such as traffic islands, embankments, ditches, holes, etc..

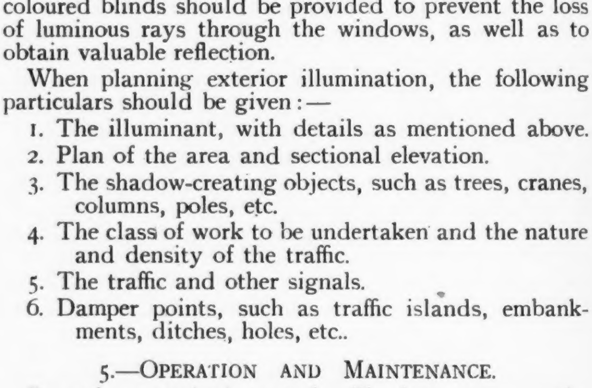
5.—Operation and Maintenance.

Properly organized control will alone secure satisfactory conditions of illumination whatever be the illuminant. If the available pressure is less than the declared one, light emission is decreased more rapidly than the diminution of pressure, while with too high a pressure the lamps will not have economic life.

All illumination installations should have the fittings, walls, ceilings, windows and blinds cleaned at regular intervals; and there should be periodical control, involving measurement, of the effective illumination. It is sound policy for owners of large installations to possess an illuminometer for this purpose.

## A Large Integrating Photometer

A correspondent sends us the enclosed illustration of an integrating sphere, 2.5 metres (approximately 7½ ft.) in diameter, which is stated to be one of the largest instruments of this type in use in Europe. This integrating sphere was recently installed in the new photometric laboratory of the B.A.G. Soc. Anonyme, Turgi (Switzerland). The primary use of the sphere is of course for measuring the luminous flux and "coefficient of utilization" of lamps and lighting fittings of all kinds. In view of the modern tendency to express values in terms of total lumens, most progressive manufacturers are now adopting integrating spheres as part of their regular equipment. In the study of fittings of large dimensions a sphere of big diameter is a distinct advantage, as errors are then reduced. This sphere is also adapted for the measurement of the reflecting power of surfaces and the transmission of different types of glass used in illuminating engineering.



# The Lighting of Atlantic City Convention Hall

WE have previously given some particulars of the lighting of this huge hall. The main auditorium covers an area of 268,000 sq. ft., the distance from the centre of the curved roof to the floor is 135 ft., and the auditorium will accommodate 41,000 people—approximately two-thirds of the permanent population of Atlantic City! The entire building is 350 ft. wide and 650 ft. high. A singular feature of the auditorium is the complete absence of windows. The lighting is entirely artificial and is indirect in character, a feature being the use of no less than 540 floodlights, each containing a 1,000-watt lamp. These lighting units are mounted on the girders and the light is reflected downwards from the ceiling, which is sprayed with aluminium paint.

These details are recalled in a contribution to a paper recently presented by Mr. A. Paulus before the Illuminating Engineering Society (U.S.A.), which is reproduced in the *Transactions* for May, 1930. The paper also contains a description of the exterior lighting. We are indebted to the courtesy of the Secretary of the Society for the three accompanying illustrations, which give a good idea of the striking effects produced.

FIG. 1.—A spectacular view of the Colonnade of Atlantic City Convention Hall, which conceals 166 1,000-watt 20-inch cast-bronze floodlight projectors. The front of the building is illuminated with light in various colour combinations.

FIG. 2.—Another distant view of the Convention Hall, floodlighted by means of projectors concealed in the Colonnade.

The first two illustrations (Figs. 1 and 2) relate to the exterior, which is completely floodlighted by night. The façade shown in Fig. 1 is lighted by 166 floodlight projectors. Attention may be drawn to the effective way in which the projectors are concealed behind the balustrade. Each floodlight can furnish red, blue or amber light, and almost any combination of colours may be obtained by the special switchboard provided. The sides and rear of the building are illuminated by 58 combination floodlighting and street-lighting units mounted on hollowspun granite columns. The striking appearance of the hall when viewed from a distance is illustrated in Fig. 2.

In Fig. 3 we have a picture showing the special arrangements adopted for the lighting of a stage devoted to boxing contests. Although large sums of money are commonly expended on such contests in this country it is common knowledge that the lighting arrangements are not always happy. A very high illumination is concentrated on the boxers in order to permit contests being filmed. The heat is sometimes excessive, and glare in the eyes both of boxers and audience is not unknown. In this case special filters have been adopted to lessen the heat, and it would seem that the arrangement shown should be free from glare. Attention may also be drawn to the illuminated clocks for timing the rounds.

The lighting of the ballroom and other interiors in this vast building also presents interesting features. The basement is used as a parking space and can accommodate about two thousand cars. The ballroom has a seating capacity for 5,000 people and a ceiling height of 75 ft. In this room there are 26 steel lunettes, 136 arches, and an outer and inner cove. Around the base of each lunette, which is a small circular dome recessed in the ceiling, trough reflectors equipped with 75-watt lamps are mounted. In each of the arches a 250-watt floodlight projector is located and is equipped with a daylight lens. Lamps placed in the lunettes and coves are equipped with red, blue, amber or clear colour-screens. The entire lighting system is controlled by means of a special switchboard, located on the stage of the ballroom. The basement is lighted by 600 diffusers, each containing a 300-watt lamp. Finally there are in the building broadcasting studios which are municipally owned and these too are lighted by special methods.

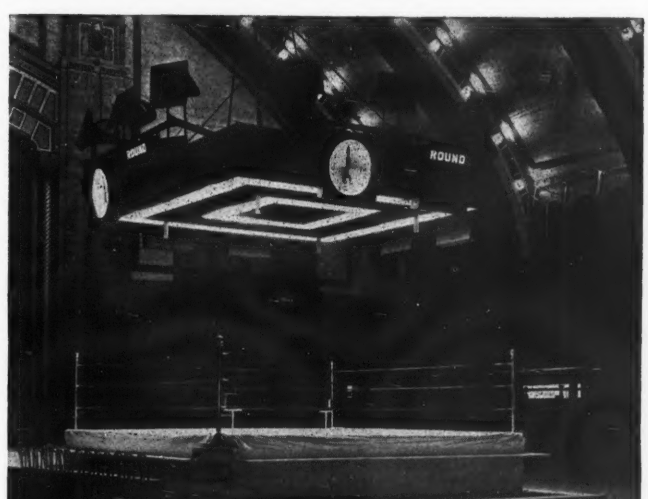



FIG. 3.—A special Lighting Fitting for Boxing Contests, containing 72 1,000-watt lamps with daylight heat-absorbing glass screens over the mouth of reflectors.

# An Architectural Course for Illuminating Engineers

THE cordial relations with the architectural profession established by the American Illuminating Engineering Society have culminated in an instructional course on the fundamentals of architecture, to be held in New York during September, at the premises of the Architectural League, under the auspices of the School of Architecture of the Columbia University.

On five successive days two addresses will be given each morning by well-known architects, professors of architecture and experienced lecturers on architectural subjects of importance to the illuminating engineer in the study of lighting projects.

The latter part of these days will consist of a lunch at the Architectural League, supplemented by a " talk " by a prominent architect, and followed, at 2 p.m., by a motor-coach trip to visit museums and buildings that are of appropriate interest and have an instructional relation to the subjects being studied. These inspections include viewing models of Greek and Roman buildings and modern ones, examples reflecting these ancient styles, visiting important churches and cathedrals and famous examples embodying Renaissance and modern architecture in the City.

An " Open Forum " will be held on the sixth and last day for general discussion of subjects pertinent to the course.

The following addresses will be given during the session:—

" How the Architect Designs ": His method of thinking and study, and how it differs from the engineer's approach. By H. Vandervoort Walsh.

" Ancient, Greek and Roman Architecture," and its importance in the foundation of subsequent styles. By Talbot F. Hamlin.

" A Demonstration of Architectural Designing," to show how the architect studies mass, planes and ornament. By Edgar I. Williams.

" Mediæval, Byzantine, Romanesque, Gothic and Modern Architecture," showing the changes in architecture as expressions of changes in culture and populations. By Talbot F. Hamlin.

" The Underlying Principles of Good Architectural Composition," illustrating the ideals of architecture. By John V. Van Pelt.

" Renaissance Architecture and Modern Adaptations," showing the interpretation of classic forms in new buildings, palaces and public edifices. By Talbot F. Hamlin.

" How Architectural Composition should Control Everything," including painting, interior decoration, lighting, sculpture, furnishing and landscaping. By John V. Van Pelt.

" Modern Architecture ": Dealing with the importance of the skyscraper architecture of to-day, and with new materials and problems. By Talbot F. Hamlin.

" The Architect's Vocabulary ": With mimeograph diagrams illustrating the common architectural terms to be distributed in printed form and shown as lantern slides. By G. M. Allen.

" The Architect's Relationship to a Building Project " : An endeavour to help the illuminating engineer to advantageously co-operate with the architect.

The post-prandial talks are scheduled to be by J. Monroe Hewlett, Ralph T. Walker, H. Wiley Corbett, Raymond Hood, Cass Gilbert.

There can be but little doubt that such co-operation between the architect and the illuminating engineer is of urgent importance. At the present time there is insufficient collaboration in this outstanding requirement of modern buildings to make it embody all the advantages it should possess, both as a utility building and as an artistic structure.

Recent years have shown a happy tendency towards the appreciation of the work of the illuminating engineer by the architectural profession, while the pioneer and practical work done by the " ELMA " in their architectural courses has been of great and widespread value. There is no doubt that if schools of architecture and the important professional institutions in all countries work hand-in-hand with the illuminating engineer the placing of the wires, conduits, control gear and fittings required for modern buildings will be planned simultaneously with the architectural design, thus producing a properly co-ordinated structure that is economic, satisfactory, amply flexible and eminently harmonious.

(Since the above note was written we have received particulars of a second course on " Fundamentals of Architecture," which has been arranged to take place at the Art Institute in Chicago during September 8th–12th. This course, which is conducted jointly by the School of Architecture, University of Illinois, and the Armour Institute of Technology, is organized on very similar lines to that in New York.)

# Wanted—A Reformed Calendar

By an Engineering Correspondent

THE commercial interests of gas and electricity central stations, mantle, lamp and carbon makers, and a few others connected with the illumination industry have been permanently affected by the adoption in the United Kingdom of the so-called " Daylight Saving " legislation. There is, however, another reform which would, apparently, benefit all the inhabitants of civilized nations, namely, the long overdue reform of the calendar.

The growing demand for a fixed Easter date, in many Christian lands, has recently brought this subject to the forefront. The adoption of the five-days week by Soviet Russia has been a departure from tradition that seems to have been willingly adopted by the people. Agitation for a thirteen-months year, each month having four weeks, has been long carried on in the United States.

Attention has been drawn recently to the feasibility of a perpetual calendar in which every year commenced with a Sunday, all the quarters contained 91 days, Easter Sunday would always be the ninety-ninth day of the year, while it would naturally follow that the date of Whit-Sunday would be May 26th, and Christmas Eve would regularly occur on a Sunday. Four times ninety-one only making 364, an additional day in each year would be inserted between the 30th June and the 1st July, which might be called, appropriately, Midsummer's Day, and enjoyed as an extension of the week-end, seeing that it would be inserted between a Saturday and a Sunday. This new calendar proposes that the first month of each quarter should have 31 days, the other two months 30 only, a convenient arrangement which secures for each month 26 working days, because five Sundays would be always included in the months of January, April, July and October.

The convenience of such an arrangement for all people can hardly be exaggerated: quarter days would have equal periods between them, bills of exchange, etc., with month periods would cover the same interval, arrangements of events would be greatly facilitated, as every date of all future years would be on the same day of the week.

Compensation for Leap Year's extra day would be made by the insertion of a day between the end of December and the beginning of the following year; this, like Midsummer's Day, would have no week-day name, but might be called " Leap Year's Day." It could either serve as a convenient day for preparation of matters for the New Year or be taken similarly to the Midsummer's Day as an extension of the week-end, at the time when so many family gatherings occur. The omission, once in each century, of Leap Year's Day in the customary manner would keep the calendar as astronomically correct as our present one.

The determination of the date of Easter has no religious importance and, as fixed by the system now in vogue, it may fall on any date between March 22nd

and April 25th, but with the suggested perpetual calendar it would invariably be April 8th. Everybody who has studied the present calendar, now in use in most cultured lands, has realized its inconsistency, which has arisen from the irrational blending of the Christian with the illogical Roman one. That the four last months of our twelve-months year should be called seventh (septem), eighth (octo), ninth (novem), and tenth (decem) is surely an encouragement to further investigation with, say, the ascertainment of why February has only twenty-eight days.

The Society, founded by Mr. Blochmann, the designer of the perpetual calendar, that is promoting this reform claims that it has support from 14 different countries, the approval of high authorities in state, church, finance, law, commerce, education and in many other quarters, now seeks, by a world-wide effort, to introduce the new calendar on January 1st, 1933, as this will be a Sunday.

The gain secured by the artificial displacement of time under the Willett daylight-saving scheme has become so firmly founded that no recurrence to the astronomical time in summer months is conceivable, and there can therefore be but inconspicuous objection to the introduction of this truly economic, albeit simple reform, both practical in its nature and of a truly permanent value.

# The Determination of Effective Illumination in Enclosed Spaces *

By Dr. L. BLOCH

ALTHOUGH illumination has been so fully studied in the last twenty-one years, and rules governing the lighting of streets and buildings have been framed, there is lacking a proper basis of judgment of conditions of illumination in ordinary rooms.

The widely accepted principle of determining the illumination by measurements on a horizontal plane has demonstrated, within limitations, many advantages. Nevertheless, efforts to attain a more exact estimation of the actual distribution of light in space has recently been made. Two papers were presented at the annual meeting of the Illuminating Engineering Society held in 1929, the first advocating the measuring of the mean illumination of all planes in which a given point is included, and the extension of the measurements to a number of points at different levels, and the second proposing the measurement of illumination at several points in the most important horizontal plane, as well as other planes in which the points lie—in short, ascertaining the distribution around each point.

from wall surfaces in streets has not been adequately investigated, owing to the limitations of the illuminometers ordinarily used. The author prefers a tubular photometer of the Bechstein design which consists of a Lummer-Brodhun head, so arranged that an image of the surface whose brightness is being measured is projected on the cube through light-reducing media; this is compared with the brightness of a milk-glass pane, illuminated by light from an incandescent lamp. Suitable lenses inserted in the viewing tube secure the projection of ample areas from the object. The viewing tube can be pointed in any direction. Calibration is effected either by using a white surface of known reflective power receiving a definite illumination, or by using a milk-glass pane of known transparency and diffusion illuminated by a standard lamp placed at different distances from it.

With this apparatus experiments were conducted for Dr. Bloch by Mr. Pohle in a series of rooms of different types, the illumination at various points in the working plane and then on the surfaces which defined the room

TABLE I.—LIGHT DISTRIBUTION IN DIFFERENT ROOMS.

| Example No. | 1 | | | 2 | | | 3 | | | 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kind of room | Dwelling | | | Working | | | Office | | | Photometer | | |
| Tint of ceiling | Light grey | | | White | | | White | | | Black | | |
| Tint of walls | Pinky-grey | | | Grey | | | Grey | | | Black | | |
| Kind of lighting | Semi-indirect | | | Semi-direct | | | Semi-indirect | | | Semi-direct | | |
| Character of distribution | Some upwards | | | Some downwards | | | Some upwards | | | Some downwards | | |
| Material of fitting : Above | Open | | | Mottled glass | | | Matt glass | | | Mottled glass | | |
| Below | Alabaster | | | Matt glass | | | Mottled glass | | | Mottled glass | | |
| RESULTS OF BRIGHTNESS MEASUREMENTS | Max. | Min. | Mean | Max. | Min. | Mean | Max. | Min. | Mean | Max. | Min. | Mean |
| Ceiling .. Lux on white | 200 | 25 | 70 | 390 | 20 | 93·6 | 470 | 38 | 218 | 71 | 2 | 17·6 |
| Left wall „ „ | 71 | 2·8 | 17·4 | 90 | 3·6 | 40·3 | 62 | 19 | 42 | 3 | 1·2 | 2·2 |
| Right wall „ „ | 71 | 1·5 | 17·5 | 72 | 6 | 38·5 | 65 | 20 | 42 | 3·3 | 0·7 | 2·25 |
| Floor „ „ | 9 | 4 | 7·1 | 9 | 3·5 | 6·5 | 10 | 4 | 6·6 | 11·2 | 1·3 | 5·7 |
| TOTAL | 30 | | | 45 | | | 80 | | | 7 | | |

Both methods are being further investigated. It is suggested, however, that neither is the last word on the subject, and another method of approach is indicated by Dr. L. Bloch in this contribution.

As an introductory example, he takes the case of two similar rooms, decorated in white, with artificial light sources of identical candle-power, the one illuminated by "intensive" fittings concentrating light mainly on the floor, and the other by "semi-indirect" ones projecting light both upwards, downwards and sideways. The room lighted in the second manner always appears the more brilliantly illuminated, the improved effect being attributable to reflection of light from the ceiling and walls. This can be easily demonstrated if identical fittings are used in rooms differently decorated but otherwise similar, the room with light surroundings invariably appearing the best lit.

Although all this is well known, the influence of reflection from ceiling and walls in enclosed spaces and being studied. Experience indicated that measurements about a vertical plane parallel to the window surfaces were usually sufficient if made at from 6 to 10 points. To simplify comparison a mean intensity of 100 lux on the working plane was adopted and all results tabulated in "lux on white" and not in the "stilb" (i.e., Hefner candles per sq. cm.). (One "lux on white" is the brightness attained when a good white diffusing surface is illuminated with 1 lux.)

The measurements of typical rooms made in the above manner are given in Tables 1 and 2.

In example No. 1A, the green curtain on the right wall caused the low minimum value, while the frieze running around the four walls produced the maximum. Similar effects on the left wall are owing to the dark brown door. The ceiling was brilliantly illuminated over the fitting. This room had a central carpet and a brown linoleum surround. In example No. 2. the low minimum on the left wall is the result of a black board fixed to it. In this instance the light emitted above the fitting

* *Licht und Lampe*, Vol. 13, 1930, pp. 663-666; abbreviated.

TABLE II.—DISTRIBUTIONS AS AFFECTED BY DIFFERENT LIGHTING SYSTEMS IN THE ROOM USED FOR EXAMPLE NO. 3 IN TABLE I.

| Example No. | 5 | | | 6 | | | 7 | | | 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kind of lighting | Direct | | | Semi-direct | | | Semi-direct | | | Totally Indirect | | |
| Character of distribution | Strongly downwards | | | Slightly downwards | | | Slightly upwards | | | Strongly upwards | | |
| Material of fitting: Above | Enamel | | | Mottled glass | | | Open | | | Open | | |
| Below | Open | | | Matt glass | | | Mottled glass | | | Enamel | | |
| RESULTS OF BRIGHTNESS MEASUREMENTS | Max. | Min. | Mean | Max. | Min. | Mean | Max. | Min. | Mean | Max. | Min. | Mean |
| Ceiling .. Lux on white | 23 | 15 | 19 | 500 | 19 | 180 | 600 | 80 | 285 | 620 | 108 | 330 |
| Left wall „ „ | 50 | 19 | 30 | 36 | 16 | 27 | 121 | 17 | 30 | 152 | 14 | 71 |
| Right wall „ „ | 50 | 19 | 30 | 40 | 17 | 27 | 120 | 20 | 30 | 156 | 18 | 71 |
| Floor „ „ | 11 | 3·5 | 7·2 | 8·7 | 3·7 | 6·6 | 10 | 4 | 7 | 9 | 3·5 | 6·7 |
| TOTAL | 20 | | | 63 | | | 95 | | | 126 | | |

reached the high value of 430,000 " lux on white "; the floor here was entirely covered by brown linoleum.

The fourth room was a photometer room with black ceiling and walls, but a similar brown linoleum floor-covering.

The mean illumination on the working plane was also maintained at 100 lux. The reflection from the wall and frieze was ascertained to be 63 per cent., from the grey walls 49 per cent., and from the floor 11 per cent.

The values given in Table 2 may be considered characteristic of different light-distributing systems. The unpleasant impression created by direct lighting is undoubtedly due to the lack of ceiling illumination, while, when totally indirect lighting is adopted, the brilliant illumination of the ceiling and frieze often cause the working plane to appear insufficiently lit.

The measurements in Table 1 clearly indicate the influence of the reflecting power of the ceiling and walls, while those in Table 2 show a constant increase as the changes from the direct through semi-direct and semi-indirect to the totally indirect system are made.

In like manner to the above, when street lighting is being considered, the influence of the reflection from walls, if any are present, and the colour of the road and pavement surfaces play a far from unimportant role.

The author, in conclusion, claims that the figures quoted will form a valuable basis for approximate estimation of results, but hopes that other investigators will make similar measurements, so that in the future the pre-determination of the distributed illumination will become a solved problem.

## Photometry at the National Physical Laboratory

Towards the end of June last the usual annual reception was held at the National Physical Laboratory. The report for the year 1929 shows that a considerable amount of photometric work is being done, though this, of course, forms a small part of the manifold activities of the laboratory.

Useful additions have been made to the photometric equipment, notably a new mirror apparatus for the determination of polar curves and two integrating spheres, each of 1 metre diameter. A feature has been the use of photo-electric cells, which seem likely to prove a very useful adjunct to the photometric laboratory. An interesting question that has been raised in connection with such cells is whether Talbot's Law (as utilized with the rotating sector device for diminishing intensity) applies. On theoretical grounds the law should be valid if the relation between photo-electric current and flux of light is linear. All cells do not exhibit this relation, but fortunately Talbot's Law appears to be valid for non-linear as well as linear cells. Even in the case of selenium cells (for which the reaction is very far from linear) the law seems to be approximately true.

Descriptions are included in the report of a photo-electric photometer for the measurement of mean spherical candle-power and a thermionic bridge photometer, and the colour sensitivity of various types of cells is discussed. At the time of the report for the previous year the cells in use possessed relatively small sensitiveness to the red end of the spectrum. Since then red sensitive and even infra-red sensitive cells have become available. With the caesium oxide cells a reproduction of the sensitivity curve of the eye close enough to permit the comparison of sources of light of different selective colours seems possible. These red-sensitive cells have proved to be ten times as sensitive as the older type to light from a vacuum type of electric lamp, though they are not quite so constant in operation. Two recent applications of photo-electric apparatus have been for the determination of the reflection factors of discs of opal glass and for the purpose of obtaining records of daylight.

A considerable amount of work has been done on heterochromatic photometry and the validity of the flicker photometer for large colour differences is being studied. A new spectrophotometer of high precision is described.

Experiments are being continued with experimental gasfilled lamps specially constructed for use as photometric sub-standards. Results seem promising, and at present the 100-watt type appears the most reliable. Experience has shown that a paint of about 80 per cent. reflecting power gives the best results for interiors of integrating photometers. Experiments on the permanency of this paint are still proceeding; it has, however, been established that paints of much higher reflecting power are undesirable, as errors due to absorbing objects within the integrator are accentuated.

A considerable amount of Government research has been undertaken. The fundamental research on glare and visual capacity is being continued, the present aim being to determine the time of recovery of the eye after exposure to a glaring source. A kindred problem has been the study of night-driving conditions, the relation between intensity of beam, car speed and distance at which objects ahead could be distinguished being studied. Other researches in progress deal with the transmission of diffusing glassware and the reflecting power of magnesium oxide, which may attain 97.5 per cent. Daylight problems include Skylight Illumination, Daylight Factors in Deep Rooms, the Transmission of Window Glasses and the Illumination of Light Wells. A series of researches on the protection of water-colour pigments from fading is being conducted. Various types of glass have been examined. As might be expected, "Vita" glass, which is very permeable to ultra-violet radiation, affords less protection than ordinary window glass.

# POPULAR & TRADE SECTION

COMPRISING

**Installation Topics—Hygiene and Safety—**
**Data for Contractors—Hints to Consumers**

*(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)*

## Lighting for Special Trades

*(Contributed by the E.L.M.A. Lighting Service Bureau.)*

VERY little consideration will concede the point that window display, and likewise the interior display of various trades, demands special lighting.

Anyone associated even remotely with the arranging of a window display is aware that as materials differ so a different application of light becomes necessary.

*Drapers and Costumiers.*

How, for example, is it possible to retain the shining effect of such materials as brocade, silk, satin, taffeta, chiffon, velvet, shantung and artificial silk? The suggestion for drapers when faced with the question is to use beams of light. A little experimental work in the way of adjusting the beams of light is usually necessary to obtain the best results. The normal lighting from shop-window reflectors will provide the general illumination, while directional lighting should be provided from floodlights installed at the top of the window.

Should, however, the window display consist of muslin, plush, or velour velvet, flannel, charmelaine, worsted, or poplin, then the general lighting alone will produce the desired effect.

Where yellow dominates, from a light beige to reddish brown, the materials are best illuminated with pearl or opal gasfilled lamps. For bright blues, greens, and purples, the mixing of some daylight-blue lamps is recommended. In order to secure a special artistic ensemble a system of footlights may be necessary, and side lights may be used to advantage when the vertical folds of material need emphasis. Foot and side lights are also valuable in windows where models are displayed, in order to remove shadows under the nose and chin which would obtain from top lighting alone.

*Men's Wear.*

The outfitter is beset with quite a number of problems from time to time, for his window may consist of a heterogeneous mixture of goods, from the brightly coloured tie and handkerchief to the more sedate dress shirt. Or it may so happen that it is a shirting and pyjama display, with a bewildering variety of colours and patterns.

He will therefore require intense lighting for his highly coloured goods, and the lighting installation should be designed to embody plug points in order to facilitate novel lighting effects. Daylight lamps may be used to procure "outdoor atmosphere" or to introduce colour which may be readily taken up by light objects. As a display feature a coloured floodlight trained on the whole of a dress shirt display cannot fail to secure attention.

*Footwear.*

As shoes and the various kinds of leather come into the "shiny" category, high-intensity lamps become a necessity if the different grades of leather are to be appreciated. Luminous display features prove particularly effective for use with footwear, since they give added emphasis to the small individual items of the display.

*Jeweller.*

The ever-present problem of the jeweller is the provision of high lights and sparkle from the artificial lighting system of reflection. A large number of small lamps, concealed in well-designed reflectors, are essential to a display of gold and silver ornaments and the numberless jewels that are found in such windows. In many successful installations the small reflectors concealing the lamps are made to convey a luminous message.

*Furniture.*

The window of a furniture shop possesses special characteristics. The display is usually deep, and frequently necessitates the use of several rows of lighting equipment. The window may also be full of colour —wonderful chintzes, and a variety of wood and curtains. Amber colour screens over the reflectors or flame-sprayed lamps in place of clear lamps may be used with advantage and give a distinct mellow appearance to the furniture. Floodlighting, in white or colour, in the window is also effective to give emphasis to special articles. Table and floor standards and luminous ornaments are essential to impart realism while adding materially to the decorative effect.

*Carpets.*

It is of prime importance to the shopkeeper that the rich colour gradations of his carpets should be distinctly visible, and in the showroom enclosing units with 200-300-watt daylight lamps are suggested to emphasize colour contrast in the window. As many of these displays are lofty and deep, one or two rows of reflectors may be advisable, and the use of side lighting, either to aid the elimination of shadow effects or to emphasize them, may be considered.

*Butchers.*

Experiments show that the windows of butchers can be well lighted by reflectors mounted every foot run of frontage, and that a little colour imparts an appearance of freshness to the meat. A delicate pink colour screen over the mouth of the reflector is suitable, or, alternatively, one red lamp in every four may be used.

*Motor Car Showrooms.*

In addition to the spectacular and high-intensity illumination usually employed in motor car showrooms, there is ample opportunity for the skilfully introduced colour reflection from the polished bodies of the multi-coloured cars. These effects can be obtained from brilliant floodlights focussing intense beams of colour lighting in critical directions.

The suggestions embodied represent considered opinion and practice, and should be of value to the various trades mentioned. There are in shoplighting vast possibilities as yet unsounded, and the lighting both of shop windows and of interiors offers opportunities that may be used with considerable commercial benefit.

## A Unique Kinema Theatre Design

We notice in *The Bioscope* a description of a kinema theatre recently erected on Catalina Island, overlooking the Bay of Avalon, which possesses some distinctive features. The building is circular in shape and is entirely surrounded, at a height of 16 ft. from the ground, by a 14 ft. loggia, affording a wonderful sea view. The auditorium, seating 2,500 people and 138 ft. in diameter, is of novel design. The dome springs direct from the floor line and forms an unbroken sweep, without a single pillar being introduced to obstruct the view. The lighting is equally unusual. There are no centre lights. Instead of this there is a 7 ft. inner wall faced in old gold. Behind this wall 400 floodlights are assembled to illuminate the dome, which has a silvered surface. The lower parts of the wall contain a series of mural decorations depicting allegorical and historical scenes. The ballroom, situated immediately over the theatre, is believed to be the largest in the world. This also is in the form of a perfect dome, 158 ft. in diameter. It can accommodate 5,000 dancers and about 1,000 additional spectators round the room. In this case there is a gigantic crystal shower-light from the centre of the dome and the ceiling is divided into 32 segments each of which received supplementary floodlighting.

## The Illumination of Mysore Palace

It is interesting to observe from time to time instances of the use of spectacular lighting in distant lands. The accompanying illustration, sent us by a correspondent, shows the illumination of the palace of His Highness

the Maharajah of Mysore (India). It will be seen that the whole frontage of the building is illuminated, whilst in the foreground there are clusters of lamps in diffusing globes mounted on pillars. We gather that this illumination, which is on an unprecedented scale, is a permanent installation. Power is derived from an adjacent hydro-electric generating station.

## The Effect of Underrunning Electric Lamps

A recent article in *l'Electricien* emphasizes the folly of underrunning electric lamps. It is not unusual, even to-day, to find large consumers who make a practice of ordering lamps for voltages less than those actually furnished on their circuit. Various motives are assigned. Sometimes the step is taken as a precaution against excessive temporary pressures, which it is thought may increase fatalities amongst lamps. It should, however, be remembered that the pressure at the lamp holder is frequently considerably below that furnished by the supply company owing to the drop in the wiring; one may assert with confidence that 90 per cent. of consumers in any case operate their lamps below the declared pressure owing to this cause, and there is no need to underrun lamps still more. Other consumers—and this is perhaps the most frequent case—believe that by underrunning their lamps they prolong the life and thus make a saving, but they quite overlook the fact that the lamps are being used uneconomically and that this involves a greater loss. Even if they consider that the illumination with the underrun lamps is adequate, they should reflect that it would probably be possible to obtain this same illumination with lamps of 25 per cent. less consumption if they were operating at the correct voltage instead of at a pressure of 10 per cent. below that for which they are intended. The author illustrates this point by several calculations based on actual installations. He shows that in a typical case the economic loss due to underrunning lamps by 10 per cent. amounts to 14 per cent.

## A Novel Searchlight Installation

The accompanying illustration shows a novel use for searchlights. This revolving searchlight was supplied by the London Electric Company to a town in the Midlands on the occasion of special carnival festivities. Special design was necessary as the ordinary standard searchlight only needs to be operated through a

relatively small angle; whereas in this case it was desired to sweep the horizon through a complete angle of 360 degrees. This installation, which attracted much attention, was supplemented by a number of floodlighting projectors equipped with colour screens and producing varied light effects.

## The E.D.A. Visit to America

A pleasant event on July 18th was the luncheon at the Holborn Restaurant to welcome Lieut.-Col. W. A. Vignoles and Mr. H. T. Young on their return from the United States and Canada as representatives of the E.D.A. Col. Vignoles, in his address, quoted figures illustrating the magnitude of the electrical industry in the United States. He emphasized the importance attached by electric supply undertakings to "giving service," and the detailed and scientific way in which businesses prepared plans for selling their goods. Every effort was made to establish friendly relations with the consumer. A feature was the way in which "good lighting" was sold. It was the practice for each supply undertaking to organize a staff of engineers who were trained as specialists in lighting, and whose advice was available to all consumers. By constant personal touch the standard of lighting had been raised very materially and substantially increased revenue had been obtained.

## The Protection of Lamp Holders

Our attention has been drawn to one point of considerable importance in lighting installations, i.e., the possibility of shocks being received from lamp holders. In the Factory and Workshop Act (Memorandum on Electricity Regulations, Form 928, 3rd Edition, p. 25) it is remarked: "It is frequently overlooked in the case of lamp holders of the screw-socket type now generally used with high candle-power lamps that the metal cap of the lamp is live. On many such lamps the cap of the lamp extends far outside the holder, and there is danger of shock to anyone touching it, or there may be danger through the lamp cap being in contact with other metal work. Such lamp holders should be provided with a petticoat or shroud to surround the cap of the lamp so that it cannot be touched."

The importance of effective screening is thus clearly indicated, but some little doubt seems to exist regarding the conditions under which this is usually considered necessary. In actual fact the Home Office Regulations only require that lamp holders should be screened for pressures above 250 volts direct current or 125 volts alternating current. As, however, direct current supplies are being changed over to alternating all over the country at the present time and as there are very few supplies of alternating current which do not exceed 125 volts, there are few circuits which come under the exemption. Even with direct current, say, at 200-240 volts, or with alternating current at 110 volts, there is still risk of shock with the use of such lamp holders: shrouded lamp holders may be demanded, even on such circuits as these, if it is considered that danger exists. It is therefore better that the shrouded type of lamp holder be used in all cases whatever the voltage or current. It may be mentioned that during the present year three fatal accidents, ascribed to the use of unscreened lamp holders on alternating current, have occurred.

Screw socket lamp holders with protecting skirts are now obtainable from a number of manufacturers, both for the ordinary "E.S." size and for the larger "Goliath" size, and manufacturers of the holders are gradually standardizing the skirted type to the exclusion of the old type.

It seems only a matter of time for the protected lamp holder to become universal.

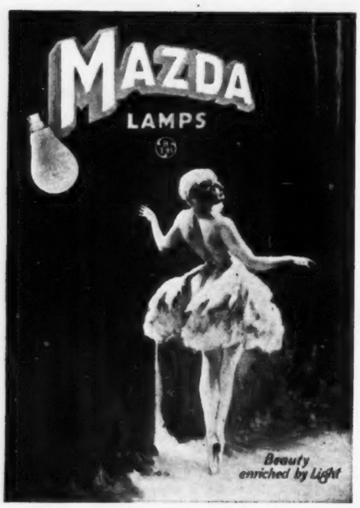
## Unlighted Refuges

A fatality recently enquired into by Mr. Ingleby Oddie, the Westminster coroner, shows the great danger of leaving street refuges unilluminated. A taxicab came into collision with a refuge in Knightsbridge. The driver was killed and the passenger injured. The police officer on duty had previously reported to the Westminster Electrical Supply Undertaking that the lamp on the refuge was unlighted. Instructions were given for the defect to be made good, but owing to a misunderstanding of the telephone message the trimmer went to the wrong locality. In the meantime the accident took place. The Coroner commented upon the serious danger of refuge lamps being left unlighted, and the jury, in returning a verdict of accidental death, added a rider that in the future trimmers should carry with them hurricane lamps for emergency use, when proceeding to make repairs. The incident shows how a device intended to aid the safety of pedestrians may become a danger to drivers of motor vehicles. The speed of traffic in our streets is now so great that dangers arising from failure of signal lights are almost as great as on the railways. Everything possible should be done to render street refuges easily recognizable. Not only should there be an evident (but not glaring) light visible, but the illumination should be so distributed as to enable the extremities of the refuge to be clearly seen.

# TRADE NOTES & ANNOUNCEMENTS

## MAZDA PUBLICITY.

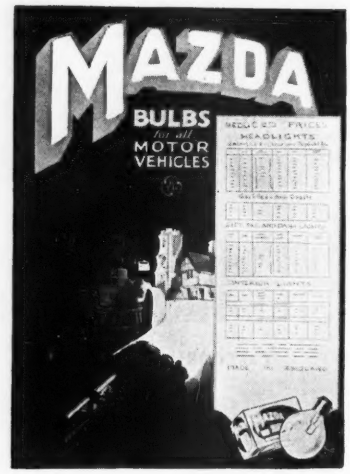
AUTUMN, 1930.




A famous Showcard to be displayed in all Underground lifts and escalators, and available to all contractors.

We have received, as usual, timely particulars of the Mazda autumn publicity campaign. For the third successive year the Mazda Dancing Girl will be a prominent feature. Her repertory, however, will be extended. She will appear in illuminated window displays, on showcards and on the covers of leaflets and catalogues, and will also make appearance in three-dimensional form as a statuette.

This season's Mazda illuminated window display is supplied in two sizes to meet the requirements of contractors. Both are supplied complete with lampholder, adapter and flexible cord. The new showcard is similar to last year's design but there are slight alterations in colouring and lettering. This card, besides being distributed through ordinary trade channels, will be exhibited in every lift and on every escalator of the Underground Railway system, and also in a large number of Metropolitan railway carriages. A new showcard dealing with Mazda motor car bulbs is available, and there are several new leaflets dealing with various types of lamps.




A Showcard Price List giving prices and particulars of all Mazda lamps.

An interesting announcement is that practically all types of Mazda lamps are now beng packed in cartons. The new carton is simple and effective, in an attractive colour scheme of orange and blue. As usual the campaign will be supplemented by widespread press advertising. Finally a special booklet for the trade (entitled "Big in Every Respect") is being issued to contractors throughout the country.

## CARBONS FOR KINEMA PROJECTORS.

We have recently received from Messrs. Chas. H. Champion & Co., Ltd., an illustrated book ("High Intensity") specifying the conditions necessary in order to obtain high intensity and constant illumination of screens in kinema theatres. Within recent years there has developed a demand for higher screen illuminations than in the past—a consideration that demands study when the fact is borne in mind that the screens used for "talkie" films are of a semi-transparent character so as to assist the efficient reproduction of sound from the loud speaker behind them. Evidently with such a screen increased candle-power from the projector is necessary in order to maintain high illuminations, and the booklet before us makes it evident how much this depends on the design of the arc lamps and the use of carbons of high quality. Three distinct types of H.I. lamps are available. The booklet contains some useful hints on their operation and describes the characteristics of the high-intensity "ship" carbons used therewith. A table is reproduced from a recent contribution to *The Illuminating Engineer* illustrating the high intensities of screen-illumination (ranging from 55 to 220 foot-candles) obtained from such carbons. Copies of this booklet may be obtained on application to Messrs. Chas. H. Champion & Co., Ltd., 14-17, Well Street, London, W.1.

Incidentally we may mention that the firm recently held their first annual staff outing to Margate, in which the Chairman of the Company, Sir Wm. Henry, participated.

## CONTRACT CLOSED.

*The follwing contract is announced* :—

SIEMENS ELECTRIC LAMPS & SUPPLIES LTD :

*General Post Office;* for a large number of special lamps for use in engineers' head lamps.

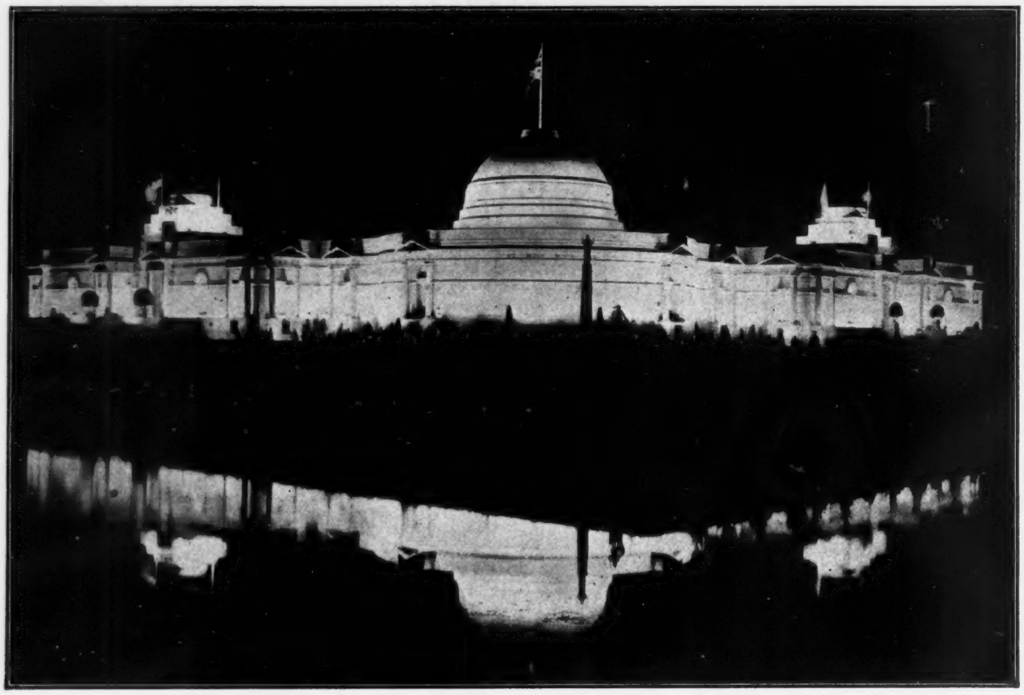


## HOLOPHANE INTERNATIONAL CONFERENCE.

We have been favoured by a complete report of the conference of Holophane Overseas Agents, which was fully dealt with in our last issue. The report makes a pleasant memento of the occasion, and the photographs taken of the party and of those present at the dinner held on the opening day have come out exceptionally well.

# INDEX (September, 1930).

# Floodlighting at the Belgian Centenary Exhibition



Showing the floodlighting of the "British Empire" Building at the Belgian Centenary Exhibition, Antwerp.

AN outstanding feature amongst the exhibits of 30 countries at the Belgian Centenary Exhibition in Antwerp was the British Empire Building, which housed many remarkable displays illustrating the industrial progress of England. A description of the floodlighting of this building recently appeared in the Osram (G.E.C.) Bulletin, to whose courtesy we are indebted for the above illustration. The total length of this building, faced with white plaster throughout, is about 440 yds., so that it offered an admirable subject for floodlighting. In all some 350 floodlights, specially designed by the G.E.C., were employed. Two features of the installation are of special interest. The first was the skilful adjustment of light and shadow to give character to the building and avoid a monotonous expanse of even brightness. Thus the "Podium Wall," immediately in front of the gardens, was lighted in a relatively subdued manner, with the result that the "British Empire," flooded with light directed almost vertically upwards, stands out brilliantly. The second point of interest was the way in which projectors were concealed from view at various points. Some were conveniently hidden behind the parapet of the "Podium Way," twin floodlights were concealed behind each of the lions at the main entrance, yet other projectors were housed in sunk wells on the lawn. The dome received special illumination from projectors mounted at intervals along the base of the encircling projecting wall. Special floodlights were also assigned for the lighting-up of the flags. The installation was carried out by the G.E.C. Illuminating Engineering Department, acting in collaboration with Messrs Campbell & Isherwood. Mr. Stephen Thomas, the well-known theatrical producer, was responsible for the lighting effects on behalf of the British Department of Overseas Trade.

## An Ingenious Sign

We are indebted to *Signs* for the accompanying illustration of an ingenious sign, described in the June issue of our contemporary. The new building of Messrs. Oxo Ltd., on the south side of the Thames, is the second highest commercial building in London. It has also the highest night sign in London without contravening the London County Council by-laws.

At first the curious decoration at the top of this tower appears to be merely an architectural decoration, but upon a second glance it will be seen that there are two large circles, divided by a cross, which spell the word oxo, and these letters are illuminated at night and blaze forth in red light. This building is 202 ft. in height, and originally it was to have been plain with the advertisement set out in electric lights, but advertisement lettering on a building of this height is banned by the London County Council. So the difficulty was ingeniously surmounted the architect including the lettering as part of the architectural design, with the electric lights inside the tower instead of outside. At night this sign can be read from Hampstead, and it is probable that in the clear summer evenings it will be seen for more than 10 miles. Each of the letters in this sign is 10 ft. across.

A daytime view of the new Oxo Building on the south side of the river Thames.